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Report on the technical review of the seventh national communication of Liechtenstein

Parties included in Annex I to the Convention were requested by decision 9/CP.16 to submit their seventh national communication to the secretariat by 1 January 2018. According to decision 15/CMP.1, Parties included in Annex I to the Convention that are also Parties to the Kyoto Protocol are required to include in their national communications supplementary information under Article 7, paragraph 2, of the Kyoto Protocol. This report presents the results of the technical review of the seventh national communication and relevant supplementary information under the Kyoto Protocol of Liechtenstein, conducted by an expert review team in accordance with the "Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention" and the "Guidelines for review under Article 8 of the Kyoto Protocol".

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Contents

		Paragraphs	Page
	Abbreviations and acronyms		3
I.	Introduction and summary	1–7	4
	A. Introduction	1–3	4
	B. Summary	4–7	4
II.	Technical review of the information reported in the seventh national communication, including the supplementary information under the Kyoto Protocol	8–97	6
	A. Information on national circumstances and greenhouse gas emissions and removals	8–27	6
	B. Information on policies and measures and institutional arrangements	28–53	11
	C. Projections and the total effect of policies and measures, including information on supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol	54–79	17
	D. Provision of financial and technological support to developing country Parties, including information under Articles 10 and 11 of the Kyoto Protocol	80–83	24
	E. Vulnerability assessment, climate change impacts and adaptation measures	84–88	25
	F. Research and systematic observation	89–93	27
	G. Education, training and public awareness	94–97	28
III.	Conclusions and recommendations	98–109	29
IV.	Questions of implementation	110	31
Annex	Documents and information used during the review		32

Abbreviations and acronyms

AAU	assigned amount unit
Annex II Party	Party included in Annex II to the Convention
BR	biennial report
CER	certified emission reduction
CH_4	methane
CHF	Swiss franc
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CTF	common tabular format
ERT	expert review team
EU	European Union
F-gas	fluorinated gas
GDP	gross domestic product
GHG	greenhouse gas
HFC	hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
LULUCF	land use, land-use change and forestry
NA	not applicable
NC	national communication
NF_3	nitrogen trifluoride
NIR	national inventory report
NO	not occurring
N_2O	nitrous oxide
PaMs	policies and measures
PFC	perfluorocarbon
reporting guidelines for supplementary information	"Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol. Part II: Reporting of supplementary information under Article 7, paragraph 2"
SF_6	sulfur hexafluoride
UNFCCC reporting guidelines on NCs	"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications"
WAM	'with additional measures'
WEM	'with measures'
WOM	'without measures'

I. Introduction and summary

A. Introduction

1. This is a report on the centralized technical review of the NC7 of Liechtenstein. The review was coordinated by the secretariat in accordance with the "Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention", particularly "Part V: UNFCCC guidelines for the technical review of national communications from Parties included in Annex I to the Convention" (annex to decision 13/CP.20), and the "Guidelines for review under Article 8 of the Kyoto Protocol" (annex to decision 22/CMP.1 and annex I to decision 4/CMP.1).[1]

2. In accordance with the same decisions, a draft version of this report was transmitted to the Government of Liechtenstein, which provided no comments to be considered or incorporated into this final version of the report.

3. The review was conducted from 12 to 17 March 2018 in Bonn, Germany, by the following team of nominated experts from the UNFCCC roster of experts: Ms. Asia Adlan (Sudan), Mr. Menouer Boughedaoui (Algeria), Mr. Christo Christov (Bulgaria), Ms. Nancy Liliana Gamba Cabezas (Colombia), Mr. Domenico Gaudioso (Italy), Mr. Liviu Gheorghe (Romania), Mr. Dirk Günther (Germany), Ms. Fui Pin Koh (Malaysia), Ms. Sangchan Limjirakan (Thailand), Mr. Juan Luis Martin Ortega (Spain), Mr. Engin Mert (Turkey), Ms. Gherghita Nicodim (Romania), Mr. Koki Okawa (Japan), Ms. Marcela Itzel Olguin-Alvarez (Mexico), Mr. Brian Quirke (Ireland), Ms. Kristina Saarinen (Finland), Ms. Marina Shvangiradze (Georgia) and Ms. Caroline Tagwireyi (Zimbabwe). Mr. Gaudioso, Ms. Saarinen and Ms. Shvangiradze were the lead reviewers. The review was coordinated by Ms. Veronica Colerio, Ms. Suvi Monni and Ms. Sevdalina Todorova (UNFCCC secretariat).

B. Summary

4. The ERT conducted a technical review of the information reported in the NC7 of Liechtenstein in accordance with the UNFCCC reporting guidelines on NCs (decision 4/CP.5) and the reporting guidelines for supplementary information, in particular the supplementary information required under Article 7, paragraph 2, and on the minimization of adverse impacts under Article 3, paragraph 14, of the Kyoto Protocol (annex to decision 15/CMP.1 and annex III to decision 3/CMP.11).

1. Timeliness

5. The NC7 was submitted on 20 December 2017, before the deadline of 1 January 2018 mandated by decision 9/CP.16.

2. Completeness, transparency of reporting and adherence to the reporting guidelines

6. Issues and gaps identified by the ERT related to the reported information are presented in table 1. The information reported by Liechtenstein in its NC7, including the supplementary information under the Kyoto Protocol, mostly adheres to the UNFCCC reporting guidelines on NCs.

[1] At the time of the publication of this report, Liechtenstein had submitted its instrument of acceptance of the Doha Amendment; however, the amendment had not yet entered into force. The implementation of the provisions of the Doha Amendment is therefore considered in this report in the context of decision 1/CMP.8, paragraph 6, pending the entry into force of the amendment.

Table 1

Assessment of completeness and transparency of mandatory information reported by Liechtenstein in its seventh national communication, including supplementary information under the Kyoto Protocol

Section of NC	*Completeness*	*Transparency*	*Reference to description of recommendations*	*Supplementary information under the Kyoto Protocol*	*Completeness*	*Transparency*	*Reference to description of recommendations*
Executive summary	Complete	Transparent		National system	Complete	Transparent	
National circumstances	Complete	Transparent		National registry	Complete	Transparent	
GHG inventory	Complete	Transparent		Supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17	Complete	Mostly transparent	Issue 1 in table 15
PaMs	Complete	Transparent		PaMs in accordance with Article 2	Complete	Mostly transparent	Issue 3 in table 8
Projections and the total effect of PaMs	Mostly complete	Transparent	Issues 1 and 3 in table 14	Domestic and regional programmes and/or arrangements and procedures	Mostly complete	Transparent	Issue 1 in table 6
Vulnerability assessment, climate change impacts and adaptation measures	Complete	Mostly transparent	Issue 1 in table 17	Information under Article 10[a]	NA	NA	NA
Financial resources and transfer of technology[b]	NA	NA	NA	Financial resources[c]	NA	NA	NA
Research and systematic observation	Mostly compete	Transparent	Issue 1 in table 18	Minimization of adverse impacts in accordance with Article 3, paragraph 14	Complete	Transparent	
Education, training and public awareness	Complete	Transparent					

Note: A list of recommendations pertaining to the completeness and transparency issues identified in this table is included in chapter III below.

[a] The assessment refers to information provided by Liechtenstein on the provisions contained in Article 4, paragraphs 3, 5 and 7, of the Convention reported under Article 10 of the Kyoto Protocol, which is relevant to Annex II Parties only. Assessment of the information provided by Liechtenstein on the other provisions of Article 10 of the Kyoto Protocol is provided under the relevant substantive headings under the Convention, for example research and systematic observation.

[b] Liechtenstein is not an Annex II Party and is therefore not obliged to adopt measures and fulfil obligations defined in Article 4, paragraphs 3, 4 and 5, of the Convention.

[c] Liechtenstein is not an Annex II Party and is therefore not obliged to provide information on financial resources under Article 11 of the Kyoto Protocol, including on "new and additional" resources.

3. Summary of reviewed supplementary information under the Kyoto Protocol

7. The supplementary information under Article 7, paragraph 2, of the Kyoto Protocol is incorporated in different sections of the NC7, and the supplementary information under Article 7, paragraph 1, of the Kyoto Protocol is reported in the NIR of the 2017 annual submission. Table 2 provides references to where the information is reported. The technical assessment of the information reported under Article 7, paragraphs 1 and 2, of the Kyoto Protocol is contained in the relevant sections of this report.

Table 2
Overview of supplementary information under the Kyoto Protocol reported by Liechtenstein

Supplementary information	*Reference to the section of NC7*
National registry	3.3.2
National system	3.3.3
Supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17	5.2.4
PaMs in accordance with Article 2	4.2
Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures	4.1
Information under Article 10	3.2.1, 4.2, 6.4, 6.6, 7.2, 7.3, 8, 9
Financial resources[a]	NA
Minimization of adverse impacts in accordance with Article 3, paragraph 14	Reported in the NIR of Liechtenstein's 2017 annual submission

[a] Reporting on financial resources under the Kyoto Protocol is relevant to Annex II Parties. As Liechtenstein is not an Annex II Party, it does not have an obligation to provide information on financial resources under Article 11 of the Kyoto Protocol, including on "new and additional" resources.

II. Technical review of the information reported in the seventh national communication, including the supplementary information under the Kyoto Protocol

A. Information on national circumstances and greenhouse gas emissions and removals

1. National circumstances relevant to greenhouse gas emissions and removals

(a) Technical assessment of the reported information

8. The national circumstances of Liechtenstein explain the relationship between its historical and future emission trends and the climate change policy agenda. The changing nature of those circumstances defines the factors that affect the climate policy development and implementation of the Convention. The NC7 contains key data on legislation, population trends, geography and land use, climate and climate change, economic developments, energy, transport, the buildings sector, industry, trade, the services sector, agriculture, forestry, resource efficiency and wastewater.

9. Liechtenstein presents a detailed description of the national circumstances and elaborates on the framework legislation and key policy documents on climate change. In addition to domestic legislation, Liechtenstein implements numerous parts of EU legislation and has participated in various EU programmes since joining the European Economic Area in 1995.

10. The ERT noted that during the period 1990–2015 Liechtenstein's population and GDP increased by 30.1 and 91.4 per cent, respectively, while GHG emissions per capita decreased by 33.1 per cent.

11. At the end of 2015, Liechtenstein had a population of 37,622. One third (34.0 per cent) of the population and two thirds of the workforce are foreign citizens. The population density in 2015 was 234 inhabitants per km^2.

12. Liechtenstein is progressing on its path to decouple economic growth from GHG emissions with its climate policies (see section II.B). Table 3 illustrates the national circumstances of Liechtenstein by providing some indicators relevant to emissions and removals.

13. Liechtenstein is a very small country with a very close and specific cooperation with Switzerland that is governed by different bilateral cooperation agreements, among them the Customs Treaty, which ensures an open border between Liechtenstein and Switzerland. All trade and customs treaties concluded between Switzerland and third countries apply to Liechtenstein pursuant to the Customs Treaty. Under the Currency Treaty, Liechtenstein uses the Swiss franc as the official currency.

Table 3
Indicators relevant to greenhouse gas emissions and removals for Liechtenstein for the period 1990–2015

						Change (%)	
Indicator	*1990*	*2000*	*2010*	*2014*	*2015*	*1990–2015*	*2014–2015*
GDP per capita (thousands 2010 USD)	107.46	145.66	156.13	158.63	158.07	47.1	–0.3
GHG emissions without LULUCF per capita (t CO_2 eq)	7.97	7.45	6.40	5.44	5.33	–33.1	–1.9
GHG emissions without LULUCF per GDP unit (kg CO_2 eq per 2010 USD)	0.07	0.05	0.04	0.03	0.03	–54.5	–1.6

Sources: (1) GHG emission data: Liechtenstein's 2017 GHG inventory submission, version v6; (2) population: World Bank; (3) GDP: United Nations Statistics Division.

Note: The ratios per capita and per GDP unit are calculated relative to GHG emissions without LULUCF; the ratios are calculated using the exact (not rounded) values and may therefore differ from a ratio calculated with the rounded numbers provided in the table.

(b) Assessment of adherence to the reporting guidelines

14. The ERT assessed the information reported in the NC7 of Liechtenstein and recognized that the reporting is complete, transparent and adhering to the UNFCCC reporting guidelines on NCs. There were no issues raised during the review relating to the topics discussed in this chapter of the review report.

2. Information on greenhouse gas emissions and removals

(a) Technical assessment of the reported information

15. Total GHG emissions[2] excluding emissions and removals from LULUCF decreased by 13.0 per cent between 1990 and 2015, whereas total GHG emissions including net emissions or removals from LULUCF decreased by 10.7 per cent over the same period. Table 4 illustrates the emission trends by sector and by gas for Liechtenstein.

[2] In this report, the term "total GHG emissions" refers to the aggregated national GHG emissions expressed in terms of CO_2 eq excluding LULUCF, unless otherwise specified. Values in this paragraph are calculated based on the 2017 annual submission, version v6.

Table 4
Greenhouse gas emissions by sector and by gas for Liechtenstein for the period 1990–2015

	GHG emissions (kt CO_2 eq)					*Change (%)*		*Share (%)*	
	1990	*2000*	*2010*	*2014*	*2015*	*1990–2015*	*2014–2015*	*1990*	*2015*
Sector									
1. Energy	201.07	219.83	193.77	154.05	162.32	–19.3	–1.1	87.7	81.4
A1. Energy industries	0.18	2.77	3.26	2.51	2.05	1 062.9	–18.6	0.1	1.0
A2. Manufacturing industries and construction	36.32	36.46	26.11	27.15	27.44	–24.5	1.1	15.8	13.8
A3. Transport	76.75	91.31	77.84	74.16	61.87	–19.4	–16.6	33.5	31.0
A4. and A5. Other	87.45	88.45	85.42	59.10	69.81	–20.2	18.1	38.2	35.0
B. Fugitive emissions from fuels	0.37	0.83	1.14	1.13	1.16	215.2	2.5	0.2	0.6
C. CO_2 transport and storage	NO	NO	NO	NO	NO	NA	NA	NA	NA
2. IPPU	0.45	4.46	9.99	10.99	10.70	2 264.5	–2.7	0.2	5.4
3. Agriculture	25.51	21.48	24.18	24.39	24.09	–5.6	–1.2	11.1	12.1
4. LULUCF	3.51	22.01	21.08	13.76	8.32	137.2	–39.5	NA	NA
5. Waste	2.18	2.36	2.41	2.39	2.28	4.6	–4.6	1.0	1.1
6. Other	NO	NO	NO	NO	NO	NA	NA	NA	NA
Gas[a]									
CO_2	198.78	216.72	190.81	161.33	159.55	–19.7	–1.1	86.7	80.0
CH_4	19.53	17.36	19.85	19.83	19.50	–0.2	–1.7	8.5	9.8
N_2O	10.90	9.85	9.90	9.87	9.85	–9.7	–0.2	4.8	4.9
HFCs	0.00	4.11	9.69	10.64	10.42	9 974 953.5	–2.0	0.0	5.2
PFCs	NO	0.01	0.07	0.04	0.04	NA	–8.8	NA	0.0
SF_6	NO	0.09	0.02	0.12	0.04	NA	–67.8	NA	0.0
NF_3	NO	NO	NO	NO	NO	NA	NA	NA	NA
Total GHG emissions without LULUCF	**229.21**	**248.14**	**230.35**	**201.82**	**199.39**	**–13.0**	**–1.2**	**100.0**	**100.0**
Total GHG emissions with LULUCF	**232.72**	**270.15**	**251.42**	**215.58**	**207.71**	**–10.7**	**–3.7**	**NA**	**NA**

Source: GHG emission data: Liechtenstein's 2017 annual submission, version v6.
[a] Emissions by gas without LULUCF and without indirect CO_2.

16. The decrease in total emissions was driven mainly by factors such as fuel prices and intensified efforts to reduce fuel combustion activities in the energy sector, particularly in transport and other sectors.

17. Between 1990 and 2015, GHG emissions from the energy sector decreased by 19.3 per cent (38.75 kt CO_2 eq) owing mainly to an overall reduction in the use of fossil fuel for energy. The trend in GHG emissions from fuel combustion showed notable decreases in transport (19.4 per cent or 14.89 kt CO_2 eq) and other sectors (20.2 per cent or 17.64 kt CO_2 eq). Between 2014 and 2015 emissions from the transport sector decreased mainly owing to a shift in the fuel prices, which decreased in Austria and increased in Liechtenstein between 2013 and 2015, leading to less fuel purchased in Liechtenstein and thus a decrease in emissions accounted for in the Party's inventory. Furthermore, various emission reduction measures in Liechtenstein are influencing the fuel consumption, such as the increase in the CO_2 tax in 2010 and the installation of a district heating pipeline used to import heat from Switzerland.

18. Between 1990 and 2015, GHG emissions from IPPU increased by 2,264.5 per cent (10.24 kt CO_2 eq) owing mainly to an increase in HFC emissions because of the role of HFCs as substitutes for chlorofluorocarbons. The most important source category is refrigeration and air conditioning. During the review, the Party explained that the main

factors influencing the increase in HFC emissions in refrigeration and air conditioning are the increasing population of Liechtenstein (30.1 per cent increase in 2015 compared with 1990), the increasing number of households in Liechtenstein (57 per cent increase), the increasing number of persons employed in the industrial and service sectors (87 per cent increase) and the increasing number of registered cars (71 per cent). SF_6 and PFC emissions play a minor role. Between 1990 and 2015, GHG emissions from the agriculture sector decreased by 5.6 per cent (1.42 kt CO_2 eq), owing mainly to a decrease in CH_4 emissions from enteric fermentation. During the review, the Party explained that the emissions basically follow the cattle population number, which decreased from 1990 to 2015, as emissions from cattle contribute to over 91.6 per cent of the enteric fermentation emissions. A second relevant development in enteric fermentation is the increasing productivity of dairy cattle (high-yield cattle), which results in higher (per animal) emission factors. The emissions from manure management also closely follow the development of the cattle population. Under the agricultural soils category, the emissions from animal manure applied to soils is the most important subcategory and also depends on the cattle population number, as well as a change in husbandry systems from stall towards loose housing systems (in the course of the agricultural policy reforms during the 1990s and the early twenty-first century).

19. The LULUCF sector was a net source of 8.32 kt CO_2 eq in Liechtenstein in 2015; net GHG emissions have increased by 4.82 kt CO_2 eq since 1990. The trend was mainly driven by changes in gain and loss of living biomass in forests. There is a considerable annual variation in loss of living biomass in forests depending on the wood harvesting rate. In 1994 and 2000 as well as 2006–2014 the loss of living biomass in forests was larger than the gain. The total net emissions increased by 137.2 per cent between 1990 and 2015. Between 1990 and 2015, GHG emissions from the waste sector increased by 4.6 per cent (0.1 kt CO_2 eq) owing mainly to changes in wastewater treatment, where emissions have increased in the period 1990–2015 as a result of the increase in Liechtenstein's population, as well as to increased emissions from biological treatment of solid waste.

20. CO_2 is the dominant GHG emitted in Liechtenstein, contributing 80.0 per cent to the total emissions in 2015. In comparison with 2014, CO_2 emissions (excluding LULUCF) decreased by 1.1 per cent in 2015, while compared with 1990, they decreased by 19.7 per cent. The dominant sector is energy (see para. 17 above for drivers).

21. In 2015, CH_4 emissions represented 9.8 per cent of the total emissions. Excluding LULUCF, CH_4 emissions decreased by 0.2 per cent in 2015 compared with 1990 and 1.7 per cent compared with 2014. N_2O emissions represented 4.9 per cent of the total emissions in 2015. Compared with 1990, N_2O emissions decreased by 9.7 per cent in 2015 and have decreased by 0.2 per cent compared with 2014. The dominant sector in terms of CH_4 and N_2O emissions is agriculture (see drivers in para. 18 above). Emission trends are affected mainly by animal stock numbers. The F-gases stem from the IPPU sector. HFC emissions in 2015 were 5.2 per cent of the total emissions. From 1990 to 2015 HFC emissions increased significantly owing to their role as substitutes for chlorofluorocarbons. SF_6 emissions originate from electrical transformation stations and play a minor role in the total emissions. PFC emissions are increasing on a low level. The share of the sum of all F-gases (within total emissions excluding LULUCF) increased from 0.00005 per cent in 1990 to 5.3 per cent in 2015.

22. The summary information provided on GHG emissions was consistent with the information reported in the 2017 annual submission.

(b) Assessment of adherence to the reporting guidelines

23. The ERT assessed the information reported in the NC7 of Liechtenstein and identified an issue relating to transparency and adherence to the UNFCCC reporting guidelines on NCs. The finding is described in table 5.

Table 5
Findings on greenhouse gas inventory information from the review of the seventh national communication of Liechtenstein

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement specified in paragraph 12	In the NC7, Liechtenstein provided some information on the factors underlying emission trends. However, the information was provided at a rather general level. For example, for the IPPU sector, it was only stated that use of F-gases increased but the factors underlying such an increase were not elaborated.
	Issue type transparency	During the review, Liechtenstein provided additional information on factors underlying emission trends (see para. 18 above).
	Assessment encouragement	The ERT encourages Liechtenstein to improve transparency by providing more information on factors underlying emission trends, in line with information provided during the review, in its next NC.

Note: Paragraph number listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on NCs. The reporting on the requirements not included in this table is considered to be complete, transparent and adhering to the UNFCCC reporting guidelines on NCs.

3. National system for the estimation of anthropogenic emissions by sources and removals by sinks

(a) Technical assessment of the reported information

24. Liechtenstein provided in the NC7 a description of how its national system for the estimation of anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol is performing the general and specific functions defined in the annex to decision 19/CMP.1. The description includes all the elements mandated by paragraph 30 of the annex to decision 15/CMP.1. The NC7 also contains a reference to the NIR of the 2017 annual submission, which includes a description of the national system. The ERT took note of the review of the changes to the national system reflected in the report on the individual review of the 2016 annual submission of Liechtenstein.

(b) Assessment of adherence to the reporting guidelines

25. The ERT assessed the information reported in the NC7 of Liechtenstein and recognized that the reporting is complete and transparent. No issues relating to the topics discussed in this chapter of the review report were raised during the review.

4. National registry

(a) Technical assessment of the reported information

26. In the NC7 Liechtenstein provided information on how its national registry performs the functions in accordance with the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1 and complies with the requirements of the technical standards for data exchange between registry systems. Liechtenstein adhered to the consolidated registry of the EU to operate its national registry system. The ERT took note of the review of the changes to the national registry reflected in the report on the individual review of the 2016 annual submission of Liechtenstein.

(b) Assessment of adherence to the reporting guidelines

27. The ERT assessed the information reported in the NC7 of Liechtenstein and recognized that the reporting is complete and transparent. No issues relating to the topics discussed in this chapter of the review report were raised during the review.

B. Information on policies and measures and institutional arrangements

1. Domestic and regional programmes and/or legislative arrangements and procedures related to the Kyoto Protocol

(a) Technical assessment of the reported information

28. For the second commitment period of the Kyoto Protocol, from 2013 to 2020, Liechtenstein committed to reducing its GHG emissions by 16 per cent below the base-year level. To achieve its target, Liechtenstein's priority remains to implement domestic measures even though the Party also plans to use credits from the Kyoto Protocol's flexible mechanisms. The legal framework that ensured the focus on domestic emission reduction measures has been transferred into the Emissions Trading Act from September 2012. The engagement in flexible mechanisms is guided by the National Climate Protection Strategy, which was revised in 2015.

29. Implementation of the Kyoto Protocol by Liechtenstein is underpinned by the Emissions Trading Act and the CO_2 Act, which set up the general framework for the fulfilment of Liechtenstein's emission reduction obligations originating from the ratification of the Kyoto Protocol.

30. The overall responsibility for climate change policymaking lies with the Ministry of Environment and the Office of Environment, which are the coordinating authorities with respect to the execution of the National Climate Protection Strategy and the implementation of the climate policy.

31. Liechtenstein has legislative arrangements and administrative procedures in place to make information publicly accessible. The administration offices that are in charge of the execution of the individual measures are responsible for monitoring the effects of individual PaMs. These authorities provide annual reports of their activities to the Parliament. These reports are made publicly available. Liechtenstein explained that the domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures are included in the Emissions Trading Act and the CO_2 Act and that the information on legislative arrangements is publicly available in the Office of Environment's web page.

32. Liechtenstein reported in the NC7 that the current Forestry Act (1991) includes the qualitative and quantitative (prohibition of clearing) preservation of the forest stocks and the promotion of nature-friendly forest management. International agreements (e.g. Helsinki Ministerial Conference on the Protection of Forests in Europe, 1993) provide the basis for forest management in Liechtenstein. The Party maintains forest reserves to the extent of 19 per cent of the forest area where all forms of forestry activities are prohibited as well as special forest areas of about 7 per cent to preserve old and traditional forms of forest management or rare forest communities. The ERT noted that information reported by Liechtenstein did not describe the national legislative arrangements and administrative procedures in place that seek to ensure that the implementation of activities under Article 3, paragraph 3, forest management under Article 3, paragraph 4, and any elected activities under Article 3, paragraph 4, of the Kyoto Protocol also contributes to the conservation of biodiversity and the sustainable use of natural resources.

(b) Assessment of adherence to the reporting guidelines

33. The ERT assessed the information reported in the NC7 of Liechtenstein and identified an issue relating to completeness. The finding is described in table 6.

Table 6
Findings on domestic and regional programmes and/or legislative arrangements and procedures related to the Kyoto Protocol from the review of the seventh national communication of Liechtenstein

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation*
1	Reporting requirement specified in paragraph 38 Issue type: completeness	Liechtenstein provided information on its forestry policies in its NC7 but did not describe its national legislative arrangements and administrative procedures put in place that seek to ensure that the implementation of activities under Article 3, paragraph 3, forest management under Article 3, paragraph 4, and any elected activities under Article 3, paragraph 4, of the Kyoto Protocol also contribute to the conservation of biodiversity and the sustainable use of natural resources.
	Assessment: recommendation	The ERT reiterates the recommendation made in the previous review that the Party report in the next submission on the administrative procedures and legislative arrangements that seek to ensure that the implementation of activities under Article 3, paragraph 3, forest management under Article 3, paragraph 4, and any elected activities under Article 3, paragraph 4, of the Kyoto Protocol also contribute to the conservation of biodiversity and the sustainable use of natural resources.

Note: Paragraph number listed under reporting requirement refers to the relevant paragraph of the reporting guidelines for supplementary information. The reporting on the requirements not included in this table is considered to be complete and transparent.

2. Policies and measures, including those in accordance with Article 2 of the Kyoto Protocol

(a) Technical assessment of the reported information

34. Liechtenstein provided information on its package of PaMs implemented, adopted and planned, by sector and by gas, in order to fulfil its commitments under the Convention and its Kyoto Protocol. Liechtenstein reported on its policy context and legal and institutional arrangements put in place to implement its commitments and monitor and evaluate the effectiveness of its PaMs.

35. Liechtenstein provided information on a set of PaMs similar to those previously reported. However, the information was more comprehensive in most sectors, and included updated information, for example in relation to the planned revision of the CO_2 Act. There are no changes made since the previous submission to Liechtenstein's institutional, legal, administrative and procedural arrangements used for domestic compliance, monitoring, reporting, archiving of information and evaluation of the progress made towards its target.

36. Liechtenstein gave priority to implementing the PaMs that make the most significant contribution to its emission reduction efforts. Liechtenstein provided information on how it believes its PaMs are modifying longer-term trends in anthropogenic GHG emissions and removals in accordance with the objective of the Convention. Liechtenstein reported on how it periodically updates its PaMs to reduce greater levels of emissions and on the PaMs that have been discontinued since the previous submission.

37. Some PaMs are deferred to the local level. In its NC7, Liechtenstein reported on the autonomy of the municipalities to conduct their affairs and to manage the municipal assets. During the review, the Party explained that municipalities are involved in climate policy through regular meetings of mayors, where planned actions and climate issues are discussed to implement the national strategy and the environment law.

38. The key overarching cross-sectoral policy reported by Liechtenstein is the National Climate Protection Strategy of 2007, which was revised in 2015. In addition, the Energy Strategy 2020, the mitigation effect of which is assessed as the most significant, provides the framework for future climate policy and for Liechtenstein meeting its emission reduction target for 2020 which is, under the Convention, 20 per cent below the 1990 level by 2020 including LULUCF. Other policies that have delivered significant emission reductions are the Emissions Trading Act and the CO_2 Act. The Emissions Trading Act sets up the general framework for the fulfilment of Liechtenstein's emission reduction obligations originating from the ratification of the Kyoto Protocol. The CO_2 Act introduces

a levy on the consumption of fossil fuel (oil and natural gas), an obligation to compensate for CO_2 emissions from the use of motor fuels (gasoline and diesel) and emissions regulation for passenger cars.

39. Liechtenstein highlighted the mitigation actions that are under development, such as the revision of the emissions regulation for passenger cars in 2018 to include light-duty vehicles, and the expected revision of the CO_2 Act in 2018 or 2019. Among the mitigation actions that provide a foundation for significant additional actions, the CO_2 Act is the most significant. Table 7 provides a summary of the reported information on the PaMs of Liechtenstein.

Table 7
Summary of information on policies and measures reported by Liechtenstein

Sector	*Key PaMs*	*Estimate of mitigation impact by 2020 (kt CO_2 eq)*	*Estimate of mitigation impact by 2030 (kt CO_2 eq)*
Policy framework and cross-sectoral measures	Climate Protection Strategy	NA	NA
	Environmental Protection Act	NA	NA
	Emissions Trading Act	NA	NA
Energy	Energy Ordinance 2008	NA	NA
	Energy Strategy 2020	6.89	1.92
	CO_2 Act	NA	NA
Transport	Mobiles Liechtenstein 2015 (national transport policy)	NA	NA
	Heavy Vehicle Fee	NA	NA
	Promotion of public transport	NA	NA
Renewable energy	Green electricity label	NA	NA
	Promotion of photovoltaic systems of private owners	NA	NA
	Hydropower (plant transformed into pumped-storage plant in 2018)	NA	NA
Energy efficiency	Energy Efficiency Act	2.89	–0.09
IPPU	No PaMs reported for IPPU		
Agriculture	Agriculture Law (promotion of environment and animal-friendly agriculture as well as permanent pastures on swampy and mixed soils)	NA	NA
	Ecological equalization payments in agriculture	NA	NA
	Preservation of soil for agriculture use	NA	NA
LULUCF	Cultivation regulations in the Forestry Act aiming at sustainable cultivation of forests	NA	NA
	Ordinance on forest reserves and protected areas	NA	NA
Waste	Steam pipeline	2.2	NA

Note: The estimates of mitigation impact are estimates of emissions of CO_2 or CO_2 eq avoided in a given year as a result of the implementation of mitigation actions.

(b) Policies and measures in the energy sector

40. **Energy supply**. Liechtenstein has no fossil fuel resources of its own. Liechtenstein's own supply of energy is limited to firewood, ambient heat and electricity (hydroelectric power plants, photovoltaic systems, biogas and natural gas plants). In 2016, 22 per cent of consumed electricity was produced in Liechtenstein. Natural gas (21 per cent) and

electricity (33 per cent) constitute the greatest share of the total energy consumption. The most important policy on energy supply is the CO_2 Act, which sets a levy for oil and natural gas.

41. **Renewable energy sources**. The increased use of renewable energy sources is of central importance for the reduction in GHG emissions and accordingly for a long-term climate policy in Liechtenstein. The Energy Strategy 2020 provides future oriented impulses for the national energy policy focusing on areas such as the promotion of efficient energy use, the use of renewable energy and energy conservation. These goals correspond to the aims of the EU 2020 climate and energy package from 2008. The Energy Strategy includes a target to increase the share of renewable energy in total energy use from 8 per cent to 20 per cent by 2020. The act and the ordinance on the Liberalization of the Electricity Market provide mechanisms to support the conveyance of renewable energies. The Liechtenstein Power Authority also offers a "Green Electricity" label and certification for domestic hydropower plants and photovoltaic systems. The State subsidizes solar collectors with a contribution of CHF 250 per square metre, whereas photovoltaic systems generating electricity are subsidized with a contribution of CHF 400 per installed output (kW) within the maximum subsidy per system of CHF 400,000.

42. **Energy efficiency**. The Energy Strategy 2020 sets the target to stabilize energy consumption to 2008 levels by 2020. The Energy Efficiency Act and the Energy Ordinance of Construction Act constitute the legal framework for the implementation of energy efficiency measures relating to buildings. The Government promotes the measures for implementing the objectives laid down in the Energy Strategy 2020 with financial resources and advice. Almost all Liechtenstein municipalities provide additional funds to projects subsidized at the national level pursuant to the Energy Efficiency Act.

43. **Residential and commercial sectors**. Liechtenstein has implemented measures that focus on the efforts to promote energy conservation. For instance, government subsidies of up to CHF 200,000 are granted for the renovation of old buildings to improve insulation. In addition, the Minergie standard is promoted and employed in all new buildings of public administration. The standard requires buildings to offer a high level of comfort, economic efficiency and low energy consumption. Liechtenstein also provides subsidies for the use of solar energy for the production of hot water.

44. **Transport sector**. In 2008, Liechtenstein approved a national transport policy which includes a strategy for developing the transport sector in the medium and long term. As part of the national transport policy, the Government has implemented or prepared a wide range of projects to promote public transportation and to reduce emissions arising from transport. Examples include the expansion of the Liechtenstein Bus Authority, "Liechtenstein Takt" regional train schedule, preferential treatment of buses at traffic lights, subsidies of electric scooters and electric bicycles, tax exemptions for solar, hybrid, electric and natural gas vehicles, security measures along routes to schools and in the area of pedestrian crossings, mobility campaigns and medium-term expansion of the railway network. In 2016, the report on the transport policy and mobility strategy "Mobiles Liechtenstein 2015" was updated.

45. The NC7 explains that Liechtenstein does not have specific existing national policies to address emissions from aviation and marine bunkers as such emission sources are of minor importance. The respective emissions stem from only one small heliport. No international shipping activities occur in Liechtenstein. Liechtenstein reported in its NC7 that, owing to its national circumstances, it is not in a position to promote and/or implement decisions of the International Civil Aviation Organization and the International Maritime Organization to limit emissions from aviation and marine bunker fuels.

46. **Industrial sector**. Liechtenstein's economy has a significant emphasis on industrial production. In 2015, the production sector provided 38.4 per cent of employment, which is high in comparison with other European countries. The most important industrial branches are mechanical engineering, electrical machinery, vehicle components, dental technology, food products and construction work. Owing to Liechtenstein's limited domestic market, the larger enterprises in particular are heavily export oriented. Liechtenstein reported in its NC7 that two large industrial installations participate in the EU Emissions Trading System.

During the review, the Party explained that the main policy having an impact on the emissions from industry is the CO_2 Act.

(c) Policies and measures in other sectors

47. **Industrial processes**. Between 1990 and 2015, GHG emissions from the industrial processes sector increased from 0.45 kt CO_2 eq. to 10.70 kt CO_2 eq, mainly owing to an increase in the utilization of HFCs. Liechtenstein did not report any specific PaMs addressing the reduction of GHG emissions from the industrial processes sector in its NC7. During the review, Liechtenstein provided further information that the CO_2 ordinance also addresses emissions from HFCs, PFCs, SF_6 and NF_3 but no target on the reduction is defined. F-gases are also regulated by the Customs Treaty with Switzerland and the Swiss Ordinance on Chemical Risk Reduction.

48. **Agriculture**. Liechtenstein adopted its main agricultural PaM, the new Agricultural Law, in 2008 to promote the trend towards more ecological agriculture. The ecological equalization payments in agriculture promote ecological cultivation methods. The law on preservation of soil for agricultural use aims to permanently protect soil for agricultural use from misuse. The Water Protection Act specifies the thresholds for animal husbandry per area unit. In parallel to Switzerland, the Ecological Performance Certificate was introduced for environmentally friendly cultivation and welfare-oriented animal husbandry. All registered farms operate according to these principles. Direct payments are paid only if the practice corresponds to the provisions of the animal protection legislation and the environmental protection provisions. The use of fertilizers is strictly regulated. Since 2002, the promotion of farm animals consuming roughage is included in the direct payment system.

49. **LULUCF**. For the LULUCF sector, Liechtenstein reported only forestry PaMs. It provided information that sustainability in forestry has been of great importance since the introduction of the Forestry Regulations in 1865. The current Forestry Act (1991) includes the qualitative and quantitative (prohibition of clearing) preservation of the forest stocks and the promotion of nature-friendly forest management. In addition, international agreements such as the 1993 Helsinki Ministerial Conference on the Protection of Forests in Europe provide the basis for forest management. The National Forest Programme of Liechtenstein contributes to sustainable forest management.

50. **Waste management**. The Office of Environment and the Ministry of Environment are responsible for developing legislation and policies to ensure the recovery and environmentally sound disposal of waste, coordinating the planning of waste disposal facilities and implementation of the policy framework in close collaboration with the 11 communes. The basis for waste legislation in Liechtenstein is the Environmental Protection Act (2008). Under the Customs Treaty with Switzerland, the Swiss Federal Office for the Environment monitors the import, export and transit of wastes and hazardous wastes for Liechtenstein. The ordinance on prevention and disposal of waste from 2016 bans landfilling of combustible waste. Waste is exported to Switzerland for combustion, and steam produced by the incineration plant is used by the manufacturing industry in Liechtenstein.

(d) Minimization of adverse impacts in accordance with Article 2 and Article 3, paragraph 14, of the Kyoto Protocol

51. In the NC7, Liechtenstein reported limited information on how it strives to implement PaMs under Article 2 of the Kyoto Protocol to minimize adverse effects, including the adverse effects of climate change and effects on international trade and social, environmental and economic impacts on other Parties, especially developing country Parties. Namely, Liechtenstein reported that the Energy Strategy 2020 addressed the need to minimize adverse effects of the PaMs as required by Article 2, paragraph 3, of the Kyoto Protocol.

52. Further information on how Liechtenstein strives to implement its commitments under Article 3, paragraph 14, of the Kyoto Protocol in such a way as to minimize adverse social, environmental and economic impacts on developing country Parties was reported in

the 2017 annual submission. The Party reported on the minimization of effects on international trade and social, environmental and economic impacts on other Parties. Liechtenstein reported that its PaMs are very compatible and consistent with those of the EU in order to avoid trade distortion and non-tariff barriers to trade and to set similar incentives. The tax exemption for biofuels in Switzerland and consequently also in Liechtenstein (tax union) is limited to fuels that meet ecological and social criteria so that biofuel production does not compete with food production or cause degradation of rainforests or other valuable ecosystems. When the Party purchases emission reduction units to meet its target, the emission reductions have to prove added ecological value and demonstrate social and ethical eligibility towards the people of the host country. In addition, projects that lead to these emission reductions have to be in line with the principles of International Humanitarian Cooperation and Development.

(e) Assessment of adherence to the reporting guidelines

53. The ERT assessed the information reported in the NC7 of Liechtenstein and identified issues relating to transparency and adherence to the UNFCCC reporting guidelines on NCs. The findings are described in table 8.

Table 8
Findings on policies and measures, including those in accordance with Article 2 of the Kyoto Protocol from the review of the seventh national communication of Liechtenstein

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement[a] specified in paragraph 17 Issue type: transparency Assessment: encouragement	The NC7 of Liechtenstein did not include a textual description and table for industry PaMs. During the review, Liechtenstein explained that a separate section on industry was not included in the NC7 because of the sector's small contribution to total GHG emissions. The Party further stated that it plans to include the IPPU section and list the applicable PaMs in its next submission. The ERT encourages Liechtenstein to include in its next NC, to the extent appropriate, also for the industry sector, a textual description of the principal PaMs and a table.
2	Reporting requirement[a] specified in paragraph 23 Issue type: transparency Assessment: encouragement	Party did not include a brief description of the estimation methods for the mitigation impacts of energy sector PaMs which were reported in section 4.2 of the NC7. The ERT encourages Liechtenstein to provide a brief description of the methods used for the quantitative estimation of the impacts of PaMs, in its next NC.
3	Reporting requirement[b] specified in paragraph 36 Issue type: transparency Assessment: recommendation	In its NC7, Liechtenstein provided limited information on how it strives to implement PaMs under Article 2 of the Kyoto Protocol in such a way as to minimize adverse effects, including the adverse effects of climate change and effects on international trade and social, environmental and economic impacts on other Parties, especially developing country Parties (see para. 51 above). The Party reported that it is unable to provide further information on the economic and social requirements with which its PaMs need to be compatible and how these requirements contribute to minimizing climate change effects and adverse effects of PaMs on international trade and social, environmental and economic impacts as no data are available. However, the ERT noted that information on minimization of adverse impacts was provided in the NIR of the 2017 annual submission. The ERT recommends that Liechtenstein provide information in its next NC on how it strives to implement PaMs under Article 2 of the Kyoto Protocol in such a way as to minimize adverse effects, including the adverse effects of climate change and effects on international trade and social, environmental and economic impacts on other Parties, especially developing country Parties, for example in line with information provided in the NIR of the 2017 annual submission, or that the Party provide a reference to the section in its NIR where the information is provided.

Note: The reporting on the requirements not included in this table is considered to be complete, transparent and adhering to the UNFCCC reporting guidelines on NCs.

[a] Paragraph number listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on NCs.

[b] Paragraph number listed under reporting requirement refers to the relevant paragraph of the reporting guidelines for supplementary information.

C. Projections and the total effect of policies and measures, including information on supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol

1. Projections overview, methodology and results

(a) Technical assessment of the reported information

54. Liechtenstein reported updated projections for 2020 and 2030 relative to actual inventory data for 2015 under the WEM scenario. The WEM scenario reported by Liechtenstein includes implemented and adopted PaMs.

55. In addition to the WEM scenario, Liechtenstein reported the WAM and WOM scenarios. The WAM scenario includes planned PaMs, while the WOM scenario excludes all PaMs implemented, adopted or planned after 2015. Liechtenstein provided a definition of its scenarios, explaining that in its WEM scenario, the majority of CO_2 reduction is attributed to policies such as renovation of buildings and increased use of heat pumps, while emission reductions are also predicted for transport and energy industries. The WAM scenario includes additional measures from the Energy Efficiency Act and from the Energy Strategy 2020, such as efficiency standards for road vehicles and increased replacement of oil and gas heating with heat pumps. The definitions indicate that the scenarios were prepared according to the UNFCCC reporting guidelines on NCs.

56. The projections are presented on a sectoral basis, using the same sectoral categories as those used in the reporting on mitigation actions, and on a gas-by-gas basis for CO_2, CH_4, N_2O, PFCs, HFCs and SF_6 (treating PFCs and HFCs collectively in each case) for 2015–2030. The projections are also provided in an aggregated format for each sector as well as for a Party total using global warming potential values from the IPCC Fourth Assessment Report.

57. Liechtenstein did not report emission projections for indirect GHGs such as carbon monoxide, nitrogen oxides, non-methane volatile organic compounds or sulfur oxides.

58. Emission projections related to fuel sold to ships and aircraft engaged in international transport were reported separately and were not included in the totals. Liechtenstein reported on factors and activities affecting emissions for each sector.

(b) Methodology, assumptions and changes since the previous submission

59. During the review, Liechtenstein explained that the methodology used for the preparation of the projections is different from that used for the preparation of the emission projections for the NC6. The general methodologies used for the WEM and WAM projections are described in chapter 5.3 of the NC7. The modelling of the energy sector (fuel combustion) scenarios is the most detailed. The projections are based on Liechtenstein's Energy Strategy 2020 and on the interim report concerning the Energy Strategy, published in 2017. The basis for the projections is Scenario 2 of the Energy Strategy, which is characterized by a stabilization of energy consumption, an enhancement of renewable energy sources and a reduction in CO_2 emissions. Scenario 2 defines a package of measures, implemented stepwise until 2020, in order to reach the GHG emission target. The projections for fugitive emissions from fuels, IPPU and agriculture are based on projections for Switzerland, while for the LULUCF sector the emissions are assumed to stay at the average level of 2011–2015. Waste sector projections are based on the Party's Waste Plan. During the review, the Party explained that where Swiss projections were applied to Liechtenstein, the sectoral experts of Liechtenstein confirmed that the

circumstances in Switzerland and Liechtenstein are comparable and that the chosen method in Switzerland's NC7 is feasible also in Liechtenstein.

60. To prepare its projections, Liechtenstein relied on the key underlying assumptions and objectives of the Energy Strategy 2020 (see paras. 41 and 42 above). During the review, the Party explained that it did not use variables such as population, GDP or employment in its projections. Only the population numbers were reported in CTF table 5.

61. Liechtenstein did not provide information on sensitivity analyses in its NC7. During the review, the Party explained that sensitivity analyses were not conducted for any of the assumptions owing to resource constraints.

(c) Results of projections

62. The projected emission levels under different scenarios and information on the Kyoto Protocol targets and the quantified economy-wide emission reduction target are presented in table 9 and the figure below.

Table 9
Summary of greenhouse gas emission projections for Liechtenstein

	GHG emissions (kt CO_2 eq per year)	*Changes in relation to base-year[a] level (%)*	*Changes in relation to 1990 level (%)*
Kyoto Protocol base year[b]	231.55	NA	1.0
Quantified emission limitation or reduction commitment under the Kyoto Protocol (2013–2020)[c]	194.51	–16.0	–15.1
Quantified economy-wide emission reduction target under the Convention	186.18	–20.0	–20.0
Inventory data 1990[d]	232.72	NA	NA
Inventory data 2015[d]	207.71	–10.7	–10.7
WOM projections for 2020[e]	207.71	–10.7	–10.7
WEM projections for 2020[e]	190.92	–18.0	–18.0
WAM projections for 2020[e]	190.55	–18.1	–18.1
WOM projections for 2030[e]	207.71	–10.7	–10.7
WEM projections for 2030[e]	174.36	–25.1	–25.1
WAM projections for 2030[e]	161.41	–30.6	–30.6

[a] "Base year" in this column refers to the base year used for the target under the Kyoto Protocol, while for the target under the Convention it refers to the base year used for that target.

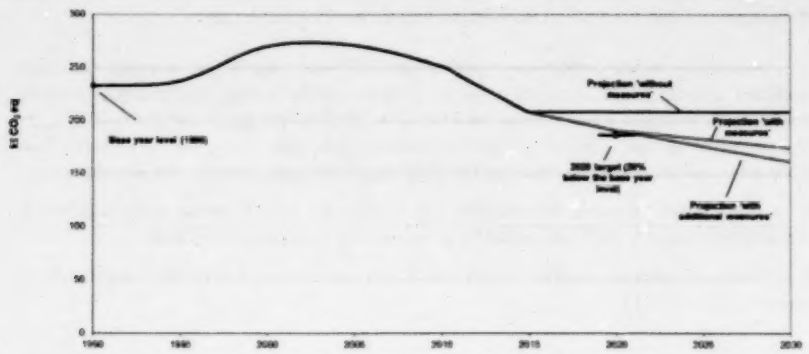
[b] The Kyoto Protocol base-year level of emissions is provided in the initial review report, contained in document FCCC/IRR/2016/LIE. For the calculation of the change in relation to the 1990 level, total emissions without LULUCF are used.

[c] The value presented in this line is the value of the assigned amount provided in document FCCC/IRR/2016/LIE divided by eight. For the calculation of the change in relation to 1990 level, total emissions without LULUCF are used.

[d] From Liechtenstein's BR CTF table 1; the emissions include LULUCF.

[e] From Liechtenstein's NC7 and/or BR3.

Greenhouse gas emission projections reported by Liechtenstein



Sources: (1) data for the years 1990–2015: Liechtenstein's 2017 annual inventory submission, version v6; total GHG emissions including LULUCF; (2) data for the years 2016–2030: Liechtenstein's NC7 and BR3; total GHG emissions including LULUCF.

63. Liechtenstein's total GHG emissions excluding LULUCF are projected to be 175.10 and 158.54 kt CO_2 eq in 2020 and 2030, respectively, under the WEM scenario, which is a decrease of 23.6 and 30.8 per cent, respectively, below the 1990 level. Under the WAM scenario, emissions in 2020 and 2030, amounting to 174.73 and 145.59 kt CO_2 eq, respectively, are projected to be lower than those in 1990 by 23.8 and 36.5 per cent, respectively.

64. Liechtenstein's total GHG emissions including LULUCF are projected to be 190.92 and 174.36 kt CO_2 eq in 2020 and 2030, respectively, under the WEM scenario, which is a decrease of 18.0 and 25.1 per cent, respectively, below the 1990 level. Under the WAM scenario, emissions in 2020 and 2030, amounting to 190.55 and 161.41 kt CO_2 eq with LULUCF, respectively, are projected to be lower than those in 1990 by 18.1 and 30.6 per cent, respectively.

65. The 2020 projections suggest that Liechtenstein may face challenges in meeting its 2020 target under the Convention, which includes LULUCF (see para. 38 above). However, the ERT notes that Liechtenstein plans to use market-based mechanisms to meet its target.

66. Liechtenstein presented the WEM and WAM scenarios by sector for 2020 and 2030, as summarized in table 10.

Table 10
Summary of greenhouse gas emission projections for Liechtenstein presented by sector

	GHG emissions and removals (kt CO_2 eq)					*Change (%)*			
	1990	*2020*		*2030*		*1990–2020*		*1990–2030*	
Sector		*WEM*	*WAM*	*WEM*	*WAM*	*WEM*	*WAM*	*WEM*	*WAM*
Energy (not including transport)	124.32	77.87	77.87	69.01	62.64	–37.4	–37.4	–44.5	–49.6
Transport	76.75	61.05	61.05	55.35	50.75	–20.5	–20.5	–27.9	–33.9
Industry/industrial processes	0.45	10.00	9.64	7.77	7.32	2 110.5	2 030.9	1 617.6	1 518.1
Agriculture	25.51	23.61	23.61	23.37	21.84	–7.4	–7.4	–8.4	–14.4
LULUCF	3.51	15.82	15.82	15.82	15.82	350.8	350.8	350.8	350.8
Waste	2.18	2.56	2.56	3.03	3.03	17.5	17.5	39.0	39.0
Other (specify)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total GHG emissions without LULUCF	**229.21**	**175.10**	**174.73**	**158.54**	**145.59**	**–23.6**	**–23.8**	**–30.8**	**–36.5**

Source: Liechtenstein's 2017 annual submission, version v6, and NC7/BR3. The ERT calculated the values for energy (not including transport) because the value reported by Liechtenstein included transport under energy.

67. According to the projections reported for 2020 under the WEM scenario, the most significant emission reductions are expected to occur in the energy and transport sectors, amounting to projected reductions of 46.43 kt CO_2 eq (37.4 per cent) and 15.75 kt CO_2 eq (20.5 per cent) between 1990 and 2020, respectively (see para. 71 below for drivers). The pattern of projected emissions reported for 2030 under the same scenario remains the same.

68. If additional measures are considered (i.e. under the WAM scenario), the patterns of emission reductions by 2020 presented by sector and by gas remain the same.

69. Liechtenstein presented the WEM and WAM scenarios by gas for 2020 and 2030, as summarized in table 11.

Table 11
Summary of greenhouse gas emission projections for Liechtenstein presented by gas

	GHG emissions and removals (kt CO_2 eq)					*Change (%)*			
	1990	*2020*		*2030*		*1990–2020*		*1990–2030*	
Gas		*WEM*	*WAM*	*WEM*	*WAM*	*WEM*	*WAM*	*WEM*	*WAM*
CO_2	198.78	136.42	136.42	122.03	111.19	–31.4	–31.4	–38.6	–44.1
CH_4	19.53	19.19	19.19	19.24	18.15	–1.7	–1.7	–1.5	–7.1
N_2O	10.90	9.68	9.67	9.64	9.06	–11.2	–11.3	–11.6	–16.9
HFCs	0.00	9.74	9.39	7.57	7.13	NA	NA	NA	NA
PFCs	NO	0.04	0.03	0.03	0.03	NA	NA	NA	NA
SF_6	NO	0.03	0.03	0.03	0.03	NA	NA	NA	NA
NF_3	NO	NO	NO	NO	NO	NA	NA	NA	NA
Total GHG emissions without LULUCF	**229.21**	**175.10**	**174.73**	**158.54**	**145.49**	**–23.6**	**–23.8**	**–30.8**	**–36.5**

Source: Liechtenstein's NC7 and BR3. The value for HFCs in 1990 presented in the NC7/BR3 is a value rounded to zero and therefore a change could not be calculated.

70. For 2020 the most significant reductions are projected for CO_2, and N_2O emissions: 62.36 kt CO_2 eq (31.4 per cent) and 1.22 kt CO_2 eq (11.2 per cent) between 1990 and 2020, respectively, in the WEM scenario.

71. The reduction in CO_2 emissions (excluding LULUCF) under the WEM scenario in the period 1990–2030 is assumed to amount to 38.6 per cent in total. A major share of these projected reductions is attributed to other sectors (1.A.4) and to the measures from the Energy Strategy 2020: renovation of buildings and increased use of heat pumps. Less pronounced reductions are predicted for the transport sector. The CH_4 emission reduction (excluding LULUCF) under the WEM scenario in the period 1990–2030 is assumed to amount to 1.5 per cent. Most of the reduction is expected to occur in 2015–2030, as the reduction in 1990–2015 was only 0.2 per cent. The Party reported in its NC7 that the decreasing trend (owing to slight reductions in energy and agriculture) is predicted to turn into a slowly increasing trend from 2024 on, owing to increasing CH_4 emissions from the waste sector. N_2O emissions follow a similar trend to CH_4 emissions in 2015–2030: although the overall reduction from 1990 to 2030 is projected to be 11.6 per cent, the emissions have already decreased from 1990 to 2015 by 9.7 per cent.

72. If additional measures are considered (i.e. in the WAM scenario), the patterns of emission reductions by 2030 presented by sector and by gas slightly change owing to the reduction in CO_2 emissions (excluding LULUCF) under the WAM scenario in the period 1990–2030 (44.1 per cent). The main reasons for this reduction are the additional measures in the energy sector under the WAM scenario (see para. 55 above). The reduction in CH_4 emissions (excluding LULUCF) in the period 1990–2030 is also relevant and is assumed to

amount to 7.1 per cent. The main reason for this reduction in the WAM scenario compared with the WEM scenario is the more pronounced reductions expected in Switzerland's WAM scenario for the agriculture sector.

(d) Assessment of adherence to the reporting guidelines

73. The ERT assessed the information reported in the NC7 of Liechtenstein and identified issues relating to completeness, transparency and adherence to the UNFCCC reporting guidelines on NCs. The findings are described in table 12.

Table 12
Findings on greenhouse gas emission projections reported in the seventh national communication of Liechtenstein

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement[a] specified in paragraph 30 Issue type: completeness Assessment: encouragement	In its NC7, Liechtenstein did not provide a sensitivity analysis or a justification for not reporting it. During the review, the Party indicated that owing to restricted resources (and given that for many sectors the estimates are adapted from Switzerland's projections) it does not plan to include a sensitivity analysis in the next NC. The ERT reiterates the encouragement made in the previous review report that Liechtenstein provide a sensitivity analysis of the projections on the key assumptions or at least provide the relevant explanations as to why it may not be feasible to provide a sensitivity analysis.
2	Reporting requirement[a] specified in paragraph 35 Issue type: completeness Assessment: encouragement	Liechtenstein did not report emission projections for indirect GHGs such as carbon monoxide, nitrogen oxides, non-methane volatile organic compounds or sulfur oxides. The ERT encourages Liechtenstein to include these projections to enhance completeness in its next NC.
3	Reporting requirement[a] specified in paragraph 42 Issue type: transparency Assessment: encouragement	Parties using models to project GHG emissions and removals and estimating the total effect of PaMs should provide sufficient information to allow a reader to obtain a basic understanding of such models. Because of the small size of the country, Liechtenstein does not have a comprehensive emission projection model developed specifically for that nation. Projections of Switzerland are used as a basis for the IPPU and agriculture sectors as well as for fugitive emissions from fuels in the energy sector. However, the NC7 lacks transparency regarding how the Swiss projections are used to derive the projections for Liechtenstein. During the review, Liechtenstein explained that because of strong social and economic similarities with Switzerland, Liechtenstein's projections are calculated by applying the relative year-to-year changes in Switzerland's projections to GHG emissions from the IPPU and agriculture sectors as well as from fugitive emissions from fuels in the energy sector. This approach is applied for both the WEM and the WAM scenario and it is reviewed by Liechtenstein sectoral experts. To increase transparency, the ERT encourages Liechtenstein to add further information on the models used in the next NC. The ERT notes that, in particular, information on the methods and key variables used in the Swiss approach and on how they have been adapted to compile the projections on GHG emissions for Liechtenstein would increase the transparency of the reporting.
4	Reporting requirement[a] specified in paragraph 43 Issue type: transparency	Liechtenstein's NC7 did not include, for each model or approach used for projections, information such as: the gases/sectors considered; the type of model used (key characteristics, original purpose); the model's strengths/weaknesses; and how it accounts for any overlap or synergies that may exist between different PaMs. In the NC7, the Party referred to the NC7 of Switzerland for sectors where

	Assessment: encouragement	Swiss models were used. During the review, the Party provided some additional information on the models and approaches used, in particular for fuel combustion. To increase transparency, the ERT encourages Liechtenstein to include in the next NC for each model and approach used for projections the following information: the gases/sectors considered; the type of model used (key characteristics, original purpose); its strengths/weaknesses; and how it accounts for any overlap or synergies that may exist between different PaMs. The ERT notes that this information is particularly relevant for the sectors for which national methods are used.
5	Reporting requirement[a] specified in paragraph 45	Liechtenstein did not report the main differences in the assumptions, methods employed and results between projections in the current NC and those in earlier NCs.
	Issue type: completeness	During the review, the Party explained that changes were made to the methodology used for the projections in NC7 compared with that used for the NC6.
	Assessment: encouragement	The ERT encourages Liechtenstein to report in its next NC on the main differences in the assumptions, methods employed and results between projections in the current national communication and those in earlier national communications.

Note: The reporting on the requirements not included in this table is considered to be complete, transparent and adhering to the UNFCCC reporting guidelines on NCs.

[a] Paragraph number listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on NCs.

2. Assessment of the total effect of policies and measures

(a) Technical assessment of the reported information

74. In the NC7 Liechtenstein did not present the estimated and expected total effect of implemented and adopted PaMs or an estimate of the total effect of its PaMs, in accordance with the WEM scenario, compared with a situation without such PaMs.

75. Table 13 provides an overview of the total effect of PaMs as calculated by the ERT based on the WOM, WEM and WAM scenarios reported by Liechtenstein. The total estimated effect of the adopted and implemented PaMs (including LULUCF) is 16.8 kt CO_2 eq and 33.36 kt CO_2 eq for 2020 and 2030, respectively. According to the information reported in the NC7, PaMs implemented in the energy and transport sector will deliver the largest emission reductions, followed by PaMs implemented in the industrial processes and agriculture sectors.

Table 13
Projected effects of Liechtenstein's planned, implemented and adopted policies and measures by 2020 and 2030

	2020		*2030*	
Sector	*Effect of implemented and adopted measures (kt CO_2 eq)*	*Effect of planned measures (kt CO_2 eq)*	*Effect of implemented and adopted measures (kt CO_2 eq)*	*Effect of planned measures (kt CO_2 eq)*
Energy (without transport)	22.58	0	31.44	6.37
Transport	0.82	0	6.52	4.6
Industrial processes	0.70	0.36	2.93	0.45
Agriculture	0.48	0	0.72	1.53
Land-use change and forestry	–7.50	0	–7.50	0
Waste management	–0.28	0	–0.75	0
Total including LULUCF	**16.8**	**0.36**	**33.36**	**12.95**

Source: Calculated by the ERT based on Liechtenstein's NC7 and/or BR3.

Note: The total effect of implemented and adopted PaMs is defined as the difference between the WOM and the WEM scenario; the total effect of planned PaMs is defined as the difference between the WEM and the WAM scenario.

(b) Assessment of adherence to the reporting guidelines

76. The ERT assessed the information reported in the NC7 of Liechtenstein and identified issues relating to completeness and adherence to the UNFCCC reporting guidelines on NCs. The findings are described in table 14.

Table 14
Findings on the assessment of the total effect of policies and measures from the review of the seventh national communication of Liechtenstein

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement specified in paragraph 39 Issue type: completeness Assessment: recommendation	Liechtenstein did not provide an estimate of the total effect of implemented and adopted PaMs in its NC7. During the review, Liechtenstein acknowledged that the information on the total effect of PaMs is not presented as the difference between different scenarios, but that the information needed to calculate the total effect of PaMs (tables 5-12 and 5-13 on WOM and WEM scenarios, respectively) is included in the NC7. The ERT recommends that Liechtenstein improve completeness of its reporting by including in its next NC the estimate of the total effect of implemented and adopted PaMs.
2	Reporting requirement specified in paragraph 39 Issue type: completeness Assessment: encouragement	Liechtenstein did not provide an estimate of the total effect of planned PaMs. During the review, Liechtenstein acknowledged that the information on the total effect of PaMs is not presented as the difference between different scenarios, but that the information needed to calculate the total effect of planned PaMs (tables 5-13 and 5-14 on WEM and WAM scenarios, respectively) is included in NC7. The ERT encourages Liechtenstein to improve completeness of its reporting by including in its next NC the estimates of the total effect of planned PaMs.
3	Reporting requirement specified in paragraph 40 Issue type: completeness Assessment: recommendation	Liechtenstein did not present the total effect of the PaMs, in accordance with the 'with measures' definition, compared with a situation without such PaMs, by gas (on a CO_2 equivalent basis). During the review, Liechtenstein recognized that with the WOM scenario as it is defined in NC7 (excluding PaMs implemented and adopted after 2015), no total effects of PaMs can be determined for the years in the past (1990–2015) but indicated that it plans to provide this information in its next NC. The ERT recommends that Liechtenstein provide, in its next NC, the total effect of the PaMs, in accordance with the 'with measures' definition, compared with a situation without such PaMs, by gas (on a CO_2 equivalent basis).

Note: Paragraph number listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on NCs. The reporting on the requirements not included in this table is considered to be complete, transparent and adhering to the UNFCCC reporting guidelines on NCs.

3. Supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol

(a) Technical assessment of the reported information

77. In the NC7 Liechtenstein provided information on how its use of the mechanisms under Articles 6, 12 and 17 of the Kyoto Protocol is supplemental to domestic action. In 2015 Liechtenstein accepted the Doha Amendment and therefore is committed to the second commitment period of the Kyoto Protocol from 2013 to 2020. Liechtenstein reported that in accordance with its Emissions Trading Act, it will reduce its GHG emissions by at least 20 per cent from 1990 to 2020 primarily by implementing domestic

measures. The Party also explained that it will use its own AAUs carried over from the first to the second commitment period. The Party further reported that it is unlikely that it will reach the target with domestic measures only, and therefore it plans use market-based mechanisms, but has not yet calculated the amount of carbon credits that need to be purchased from the international market.

78. Liechtenstein reported in table 5-16 of its NC7 that its Kyoto Protocol target (AAUs per year) is 194.51 kt CO_2 eq. The ERT noted that the difference between the target and the base-year level equals 37.05 kt CO_2 eq per year (see table 9 above). Liechtenstein explained in its NC7 that the expected use of the mechanisms under the Kyoto Protocol (such as the clean development mechanism) equals 17.64 kt CO_2 eq annually. In the CTF table 4(b), the Party reported use of CERs of 8.73 kt CO_2 eq in 2015 and 54.00 kt CO_2 eq in 2016.

(b) Assessment of adherence to the reporting guidelines

79. The ERT assessed the information reported in the NC7 of Liechtenstein and identified an issue relating to transparency. The finding is described in table 15.

Table 15
Findings on supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol from the review of the seventh national communication of Liechtenstein

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation*
1	Reporting requirement specified in paragraph 33 Issue type: transparency Assessment: recommendation	In its NC7, Liechtenstein reported that under the current projections it seems unlikely that it will achieve its reduction target for the second commitment period under the Kyoto Protocol solely by domestic measures. In order to fill the gap, Liechtenstein envisages taking the option of continuing its engagement within the Kyoto Protocol's flexible mechanism. In the NC7, Liechtenstein did not provide any further information, for example, on its purchasing programmes to obtain the required credits. During the review, Liechtenstein provided information on previous purchases of CERs but did not provide information on planned purchases. The ERT recommends that Liechtenstein transparently report in its next submission on the amount of units and any plans to acquire the units from flexible mechanisms under the Kyoto Protocol, including information on any purchasing programmes.

Note: Paragraph number listed under reporting requirement refers to the relevant paragraph of the reporting guidelines for supplementary information. The reporting on the requirements not included in this table is considered to be complete and transparent.

D. Provision of financial and technological support to developing country Parties, including information under Articles 10 and 11 of the Kyoto Protocol

80. Liechtenstein is not an Annex II Party and is therefore not obliged to adopt measures and fulfil obligations defined in Article 4, paragraphs 3, 4 and 5, of the Convention. However, Liechtenstein provided information in the NC7 on its provision of financial, technology transfer and capacity-building support to developing country Parties. The ERT commends Liechtenstein for reporting this information and suggests that it continue to do so in future NCs.

81. Liechtenstein reported information on the assistance it has provided to developing country Parties that are particularly vulnerable to the adverse effects of climate change to help them to meet the costs of adaptation to these adverse effects. Furthermore, Liechtenstein provided information on other financial resources related to the implementation of the Convention provided through bilateral, regional and other multilateral channels.

82. Liechtenstein reported that all activities and projects related to capacity-building or the transfer of technology take place within the framework of International Humanitarian Cooperation and Development, which is based on the Law on International Humanitarian

Cooperation and Development from 2007 (LGBl. 2007 Nr. 149). The law provides for four categories of development cooperation: bilateral development cooperation; multilateral development cooperation; emergency and reconstruction assistance; refugee and migration assistance. The law does not particularly mention technology transfer and capacity-building, but almost all the projects that target mitigation or adaptation have both components.

83. Liechtenstein has provided information on its financial contribution to the Adaptation Fund for 2016, established in accordance with decision 10/CP.7.

E. Vulnerability assessment, climate change impacts and adaptation measures

1. Technical assessment of the reported information

84. In the NC7 Liechtenstein provided the required information on the expected impacts of climate change in the country; the adaptation policies covering regional, sectoral and cross-sectoral vulnerabilities and considerations; and an outline of the action taken to implement Article 4, paragraph 1(b), of the Convention with regard to adaptation. Liechtenstein provided a description of climate change vulnerability and impacts on water management, biodiversity, forests, agriculture, energy, health and tourism, and highlighted the adaptation response actions taken and planned at different levels of government.

85. Impetus has been given to addressing adaptation matters with the adoption of the National Climate Change Adaptation Strategy, which provided further direction to government agencies on enhancing preparedness for climate change. In recent years, various research programmes on the effects of global climate warming in the Alpine region have been conducted. For Liechtenstein, the most important impacts are related to rising temperatures, such as prolonged heatwaves and droughts and an increase in the risk of natural hazards (e.g. flooding, landslides, debris flows). Overall, changes in climatic conditions are also expected to have an impact on biodiversity. Since temperature recording started in 1871, the average temperature has increased in Liechtenstein by 1.9 °C. The expected future impacts of climate change have primarily been studied in Switzerland and are mainly based on the Swiss Climate Change Scenarios 2011 and related updates from 2015, which also cover the area of Liechtenstein. Expected changes were assessed for temperature and temperature extremes, precipitation and precipitation extremes, including droughts and windstorms, for three different scenarios: two non-intervention emission scenarios (A2 and A1B) that anticipate increases in emissions, and one climate stabilization scenario (global temperature increase stabilized to about 2 °C). The most comprehensive study CH2014-Impacts based on these scenarios and led by the Oeschger Centre for Climate Change Research, University of Bern, investigated quantitative impacts of climate change focusing on ecological, economic and social impacts. This study was used as the basis for the adaptation strategy of Liechtenstein.

86. Table 16 summarizes the information on vulnerability and adaptation to climate change presented in the NC7 of Liechtenstein.

Table 16
Summary of information on vulnerability and adaptation to climate change reported by Liechtenstein

Vulnerable area	*Examples comments adaptation measures reported*
Water management	*Vulnerability*: increased risk of damage on infrastructure and buildings along the river Rhine; increased competition for water.
	Adaptation: regular updates of urban drainage and water supply planning taking into account climate change conditions; changes in current regulations might be necessary because of an increase in irrigation water demand; water utilization plan coordinating competing demands of water in a situation of limited water supply is implemented in certain regions of Liechtenstein – similar plans will be implemented in other regions if the drought periods increase.

Vulnerable area	*Examples comments adaptation measures reported*
Biodiversity	*Vulnerability*: spreading of alien and invasive species; increased frequency of forest fires, windstorms, prolonged drought periods and avalanches may affect forest vegetation.
	Adaptation: implementation of the management plan for the control of invasive alien plant species; development and implementation of measures for the preservation of these ecosystems; management of natural hazards; continued monitoring; implementation of the EU water framework directive.
Forest and forestry	*Vulnerability*: increase in drought periods, especially in combination with subsequent damage caused by insects (bark beetle infestations), pathogens (viruses, bacteria, fungus), forest fires and windstorms are expected to affect the provision of ecosystem services.
	Adaptation: forest management plans at the local level based on the services provided by the ecosystem and the national forest development plan based on climate change impacts; artificial regeneration of most vulnerable areas; conversion of spruce and fir stocks into mixed deciduous and coniferous forests.
Agriculture	*Vulnerability*: expected increase in drought periods, extreme rainfall events and a more rapid spreading of invasive species, pathogens and parasites under a warming climate are expected to reduce crop yields; animal husbandry might be affected by existing and new pathogens.
	Adaptation: producing biweekly information on the spreading of most important animal diseases to reduce the risk of further spreading; similar system for plant diseases is planned; integrated water utilization plans are developed for application during drought periods; recommendations for dealing with increasing heat stress in animal husbandry is planned to be implemented; measures for protection against soil erosion are already implemented.
Energy	*Vulnerability*: expected rise in temperature and increased risk of heatwaves lead to higher demand for cooling and air conditioning.
	Adaptation: passive cooling; restriction of use of cooling and air-conditioning devices.
Health	*Vulnerability*: increase in duration and frequency of heatwaves; increase in microbial pollution in drinking water resources because of increased temperature of water; ozone level rise; spreading of new vector-borne diseases.
	Adaptation: structural measures on buildings (e.g. isolation, shades, dimensioning of windows in new buildings) and planning measures (e.g. green areas, shading, orientation of new buildings); strengthening the drinking water quality monitoring system; informing the population on protective measures in case of an increase of ozone level being under continued monitoring.
Tourism	*Vulnerability*: winter tourism is strongly affected owing to reduced snow cover, especially in skiing resorts at low to medium altitudes.
	Adaptation: diversification of touristic attractions.
Management of natural hazards (cross-cutting)	*Vulnerability*: slopes currently underlain by degrading permafrost will probably become less stable at progressively higher altitudes; rock instability and the incidence of large (more than 1 million cubic metres) rock falls; quite a large number of recent slope failures have been documented in permafrost areas and have been related to increasing temperatures; changes in sediment supply and land use; increase in debris-flow magnitude and frequency; increase in frequency of landslides at lower elevations.
	Adaptation: Liechtenstein has established natural hazard maps providing regionalized information on the specific local risks of avalanches, rock fall, landslides and flooding; an early warning system is established against the river Rhine floods; a regular examination of protective structures against flooding and forest fires is envisaged.

87. Liechtenstein in its NC7 did not provide a transparent outline of the action taken to implement Article 4, paragraph 1(e), of the Convention on cooperation in adaptation planning, particularly in Africa, affected by drought and desertification, as well as floods (see table 17).

2. Assessment of adherence to the reporting guidelines

88. The ERT assessed the information reported in the NC7 of Liechtenstein and identified an issue relating to transparency. The finding is described in table 17.

Table 17
Findings on the vulnerability assessment, climate change impacts and adaptation measures from the review of the seventh national communication of Liechtenstein

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement specified in paragraph 49 Issue type: transparency	Liechtenstein's NC7 chapter 7 on financial, technological and capacity-building support referred to some projects in Africa as well as to support granted for adaptation. However, the ERT considered that this information did not constitute a transparent outline of the action taken to implement Article 4, paragraph 1(e), of the Convention regarding cooperation in adaptation planning, particularly in Africa, affected by droughts and desertification, as well as floods.
	Assessment: recommendation	During the review Liechtenstein provided detailed information on the projects and financial support provided to African countries on adaptation planning during the last years. In particular, the Party reported that about CHF 10 million per year are used to support rural development and sustainable agriculture in Africa, specifically sub-Saharan Africa and southern Africa. A significant share of this support is highly relevant for food security in the context of adaptation to climate change The ERT reiterates the recommendation made in the previous review report that Liechtenstein transparently report an outline of the action taken to implement Article 4, paragraph 1(e), of the Convention, for example by providing information corresponding to that provided to the ERT during the review.

Note: Paragraph number listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on NCs. The reporting on the requirements not included in this table is considered to be complete, transparent and adhering to the UNFCCC reporting guidelines on NCs.

F. Research and systematic observation

1. Technical assessment of the reported information

89. Liechtenstein provided information on its general policy and funding relating to research and systematic observation and both domestic and international activities, including the Global Climate Observing System. Liechtenstein reported that because of the small size of the country its activity in global programmes is limited to the IPCC membership, and that the Party is not a member of the World Meteorological Organization. Liechtenstein did not provide information on the identification of opportunities for and barriers to free and open international exchange of data and information and on action taken to overcome such barriers (see table 18).

90. Liechtenstein has implemented and planned participation in international and domestic programmes on climate change research, systematic observation and climate modelling that aim to advance capabilities to predict and observe the physical, chemical, biological and human components of the Earth's system over space and time. Liechtenstein has very limited research activities of its own but is involved in regional programmes with its neighbouring countries (Austria, Germany and Switzerland). During the review, the Party explained that most of the programmes in which Liechtenstein is engaged have co-benefits addressing technology development and/or transfer. The Party further reported in the NC7 that the most active cooperation the country has is with Switzerland, in particular for modelling GHG emissions and future trends of climatic parameters, as well as the assessment of climate change impact on different sectors. A priority regional research

project was initiated in the field of architecture and sustainable planning within the Alpine Rhine Valley. A five-year (2013–2017) research project contributed to the development of a transparent solar collector combined with an innovative indoor air-conditioning system (FLUIDGLASS).

91. In terms of activities related to systematic observation, Liechtenstein reported that, owing to its size and the limited resources within the national Administration, the country's engagement with regard to research and systematic observation that address international activities is very limited. However, Liechtenstein collects a range of meteorological data (air pressure, air temperature, relative humidity, wind direction, wind strength, precipitation, sunshine duration, etc.), both through its own measuring stations and through regional cooperation, especially with Switzerland, and the data are fed into the Global Climate Observing System. Liechtenstein did not report on challenges related to the maintenance of a consistent and comprehensive observation system except on the limitations because of the country's national circumstances.

92. The ERT considers that the NC7 does not clearly reflect actions taken to support capacity-building and the establishment and maintenance of observation systems and related data and monitoring systems in developing countries (see table 18).

2. Assessment of adherence to the reporting guidelines

93. The ERT assessed the information reported in the NC7 of Liechtenstein and identified issues relating to completeness, transparency and adherence to the UNFCCC reporting guidelines on NCs. The findings are described in table 18.

Table 18
Findings on research and systematic observation from the review of the seventh national communication of Liechtenstein

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement specified in paragraph 58	In its NC7 Liechtenstein did not report information on actions taken to support capacity-building activities in developing countries related to the participation in the global observing systems.
	Issue type: completeness	During the review, the Party explained that it has limited research of its own but is involved in collaboration with its neighbouring countries. Most of the programmes in which Liechtenstein is engaged have co-benefits addressing technology development and/or transfer having an indirect impact on the involvement of global observing systems as a potential co-benefit.
	Assessment: recommendation	The ERT recommends that Liechtenstein provide information on action taken to support systematic observation related capacity-building in developing countries in its next NC or clearly report why it is not possible to report on such actions because of its national circumstances, as explained during the review.
2	Reporting requirement specified in paragraph 62	Liechtenstein did not provide information on barriers to free and open international exchange of data and information with regards to research and systematic observation.
	Issue type: transparency	During the review Liechtenstein confirmed that the Party did not identify any particular barriers to the exchange of data and information at the international level.
	Assessment: encouragement	The ERT encourages Liechtenstein to provide information on the opportunities for and barriers to free and open international exchange of data and information and report on action taken to overcome barriers, if any.

Note: Paragraph number listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on NCs. The reporting on the requirements not included in this table is considered to be complete, transparent and adhering to the UNFCCC reporting guidelines on NCs.

G. Education, training and public awareness

1. Technical assessment of the reported information

94. In the NC7 Liechtenstein provided information on its actions relating to education, training and public awareness at the domestic and international level. Liechtenstein provided information on the general policy on education, training and public awareness, primary, secondary and higher education, public information campaigns, training programmes, education materials, resource or information centres, the involvement of the public and non-governmental organizations and its participation in international activities.

95. The Ministry of Education is responsible for the coordination of education. Relevant legislative provisions are the Education Act, the Vocational Education and Training Act and the Higher Education Act along with the corresponding ordinances. Since 2005, environmental education officially forms part of Liechtenstein's all-encompassing educational programme. The Institute of Architecture and Planning (University of Applied Science) offers a concrete climate, energy and environmentally relevant education with the Urban Sustainability, Climate and Planning Education programme. Financial support was provided by the Government for the implementation of a personal carbon footprint programme within the framework of a social networking platform (KLIMACODE). Since 2012, the Government provides financial support to LIFE Climate Foundation Liechtenstein (established in 2009) on a regular basis from which small and medium-sized enterprises can apply for financial support for the implementation of efficiency measures or the development of innovative technologies which demonstrate a GHG mitigation impact.

96. Liechtenstein did not provide information in its NC7 on the extent of public participation in the preparation or domestic review of its NCs (see table 19).

2. Assessment of adherence to the reporting guidelines

97. The ERT assessed the information reported in the NC7 of Liechtenstein and identified an issue relating to completeness and adherence to the UNFCCC reporting guidelines on NCs. The finding is described in table 19.

Table 19
Findings on education, training and public awareness from the review of the seventh national communication of Liechtenstein

No.	*Reporting requirement, issue type and assessment*	*Description of the finding with recommendation or encouragement*
1	Reporting requirement specified in paragraph 65	In its NC7 Liechtenstein did not report on the extent of public participation in the preparation or domestic review of the NC.
	Issue type: completeness	During the review the Party confirmed that there is no specific procedure designed and approved for public participation in the preparation and review of NCs, but that it is conducted under the general approach which Liechtenstein has for other government documents.
	Assessment: encouragement	The ERT encourages the Party to include in its next NC information on public participation in the preparation and review of its NCs as provided during the review.

Note: Paragraph number listed under reporting requirement refers to the relevant paragraph of the UNFCCC reporting guidelines on NCs. The reporting on the requirements not included in this table is considered to be complete, transparent and adhering to the UNFCCC reporting guidelines on NCs.

III. Conclusions and recommendations

98. The ERT conducted a technical review of the information reported in the NC7 of Liechtenstein in accordance with the UNFCCC reporting guidelines on NCs. The ERT concludes that the reported information mostly adheres to the UNFCCC reporting guidelines on NCs and that the NC7 provides an overview of the national climate policy of Liechtenstein.

99. The information provided in the NC7 includes all of the elements of the supplementary information under Article 7 of the Kyoto Protocol with the exception of

information on domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures in relation to the implementation of activities under Article 3, paragraphs 3 and 4. Supplementary information under Article 7, paragraph 1, of the Kyoto Protocol on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol was provided by Liechtenstein in its 2017 annual submission.

100. Liechtenstein's total GHG emissions excluding LULUCF were estimated to be 13.0 per cent below its 1990 level, whereas total GHG emissions covered by its quantified economy-wide emission reduction target (i.e. including LULUCF) were 10.7 per cent below its 1990 level in 2015. The decrease in total emissions was driven mainly by factors such as fuel prices and intensified efforts to reduce fuel combustion activities in the energy sector, particularly in the transport and other sectors. Between 2014 and 2015 emissions from the transport sector decreased mainly owing to a shift in the fuel prices, which decreased in Austria and increased in Liechtenstein between 2013 and 2015, leading to less fuel purchased in Liechtenstein and thus a decrease in emissions accounted for in the Party's inventory.

101. The key overarching cross-sectoral policy reported by Liechtenstein is the National Climate Protection Strategy from 2007, which was revised in 2015. In addition, the Energy Strategy 2020 provides the framework for future climate policy and for Liechtenstein meeting its emission reduction target for 2020. Key legislation supporting Liechtenstein's climate change goals include the Emissions Trading Act and the CO_2 Act. The mitigation actions with the most significant mitigation impact are the Energy Efficiency Act and Energy Strategy 2020.

102. The GHG emission projections provided by Liechtenstein include those under the WOM, WEM and WAM scenarios. In the three scenarios, emissions including LULUCF are projected to be 10.7, 18.0 and 18.1 per cent, respectively, below the 1990 level in 2020. On the basis of the reported information, the ERT concludes that Liechtenstein may face challenges in achieving its 2020 target (20 per cent reduction compared to 1990) under the WEM and WAM scenarios with domestic measures. However, the ERT notes the Party's plan to use market-based mechanisms to reach its target.

103. In its NC7, Liechtenstein reported that under the current projections it seems unlikely that it will achieve its reduction target for the second commitment period under the Kyoto Protocol solely by domestic measures. In order to fill the gap, Liechtenstein is planning to use the Kyoto Protocol flexible mechanisms.

104. The NC7 contains information on how Liechtenstein's use of the mechanisms under Articles 6, 12 and 17 of the Kyoto Protocol is supplemental to domestic action.

105. Liechtenstein is not an Annex II Party and is therefore not obliged to adopt measures and fulfil obligations defined in Article 4, paragraphs 3, 4 and 5, of the Convention. However, Liechtenstein continued to report on climate finance, technology transfer and capacity-building to developing countries in line with its climate finance programmes and on its financial contribution to the Adaptation Fund established in accordance with decision 10/CP.7.

106. In its NC7 Liechtenstein has provided detailed information on vulnerability and expected climate change impacts in different sectors according to the requirement of Article 4, paragraph 1(b), of the Convention. According to the Climate Change Adaptation Strategy of Liechtenstein the focus is on the following vulnerable sectors: water management, biodiversity, forests, agriculture, energy, health and tourism. Information provided related to actions taken to implement Article 4, paragraph 1(e), of the Convention regarding cooperation on adaptation planning and in particular with African countries is limited in the NC7 but during the review Liechtenstein provided detailed information on relevant activities.

107. Owing to limited human and administrative resources, Liechtenstein is limited in its own research and systematic observation programmes but the Party actively cooperates in these fields at the regional level. The main partners of Liechtenstein are Austria, Germany and Switzerland. Liechtenstein collects a range of meteorological data, both through its

own measuring stations and through regional cooperation, especially with , and the data are fed into the Global Climate Observing System.

108. Information reported on education, training and public awareness is comprehensive, covering, for example, the primary and secondary education and large-scale international programmes for students. Since 2012, the Government has been providing financial support on a regular basis to LIFE Climate Foundation Liechtenstein, from which small and medium-sized enterprises may apply for financial support for the development of innovative technologies.

109. In the course of the review, the ERT formulated the following recommendations for Liechtenstein to improve its adherence to the UNFCCC reporting guidelines on NCs and its reporting of supplementary information under the Kyoto Protocol:[3]

(a) To improve the completeness of its reporting by:

(i) Reporting on the administrative procedures and legislative arrangements that seek to ensure that the implementation of activities under Article 3, paragraph 3, forest management under Article 3, paragraph 4, and any elected activities under Article 3, paragraph 4, of the Kyoto Protocol also contribute to the conservation of biodiversity and the sustainable use of natural resources (see issue 1 in table 6);

(ii) Including the estimate of the total effect of implemented and adopted PaMs (see issue 1 in table 14);

(iii) Providing the total effect of the PaMs, in accordance with the 'with measures' definition, compared to a situation without such PaMs, by gas (see issue 3 in table 14);

(iv) Providing information on action taken to support systematic observation related capacity-building in developing countries or clearly reporting why it is not possible to report on such actions because of its national circumstances (see issue 1 in table 18);

(b) To improve the transparency of its reporting by:

(i) Providing information on how it strives to implement PaMs under Article 2 of the Kyoto Protocol in such a way as to minimize adverse effects, including the adverse effects of climate change and effects on international trade and social, environmental and economic impacts on other Parties, especially developing country Parties, for example in line with information provided in the NIR of the 2017 annual submission or providing a reference to the section in the NIR where the information is provided (see issue 3 in table 8);

(ii) Reporting on the amount of units and any plans to acquire the units from flexible mechanisms under the Kyoto Protocol, including information on any purchasing programmes (see issue 1 in table 15);

(iii) Reporting an outline of the action taken to implement Article 4, paragraph 1(e), of the Convention (see issue 1 in table 17).

IV. Questions of implementation

110. During the review the ERT assessed the NC7, including the supplementary information provided under Article 7, paragraph 2, of the Kyoto Protocol, and reviewed the information on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol with regard to timeliness, completeness, transparency and adherence to the UNFCCC reporting guidelines on NCs. No question of implementation was raised by the ERT during the review.

[3] The recommendations are given in full in the relevant sections of this report.

Annex

Documents and information used during the review

A. Reference documents

2017 GHG inventory submission of Liechtenstein. Available at http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/10116.php.

BR3 of Liechtenstein. Available at http://unfccc.int/national_reports/biennial_reports_and_iar/biennial_reports_data_interface/items/10132.php.

BR3 CTF tables of Liechtenstein. Available at http://unfccc.int/national_reports/biennial_reports_and_iar/biennial_reports_data_interface/items/10132.php.

"Compilation of economy-wide emission reduction targets to be implemented by Parties included in Annex I to the Convention". FCCC/SBSTA/2014/INF.6. Available at http://unfccc.int/resource/docs/2014/sbsta/eng/inf06.pdf.

"Doha amendment to the Kyoto Protocol". Available at https://unfccc.int/files/kyoto_protocol/application/pdf/kp_doha_amendment_english.pdf.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications". FCCC/CP/1999/7. Available at http://unfccc.int/resource/docs/cop5/07.pdf.

"Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol". Annex to decision 15/CMP.1. Available at http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf.

"Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol". Annex III to decision 3/CMP.11. Available at http://unfccc.int/resource/docs/2015/cmp11/eng/08a01.pdf.

"Guidelines for review under Article 8 of the Kyoto Protocol". Annex to decision 22/CMP.1. Available at http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf.

"Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention". Annex to decision 13/CP.20. Available at http://unfccc.int/resource/docs/2014/cop20/eng/10a03.pdf.

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Report on the individual review of the annual submission of Liechtenstein submitted in 2016. FCCC/ARR/2016/LIE. Available at http://unfccc.int/resource/docs/2017/arr/lie.pdf.

Report on the review of the report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol of Liechtenstein. FCCC/IRR/2016/LIE. Available at http://unfccc.int/resource/docs/2017/irr/lie.pdf.

Report of the technical review of the second biennial report of Liechtenstein. FCCC/TRR.2/LIE. Available at http://unfccc.int/resource/docs/2016/trr/lie.pdf.

Report of the technical review of the sixth national communication of Liechtenstein. FCCC/IDR.6/LIE. Available at http://unfccc.int/resource/docs/2015/idr/lie06.pdf.

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B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Heike Summer (Office of Environment), including additional material.